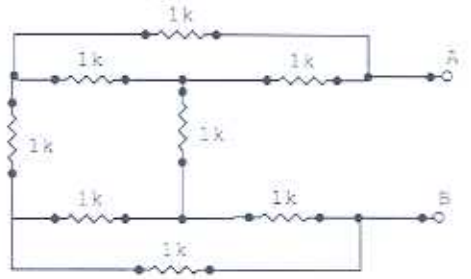
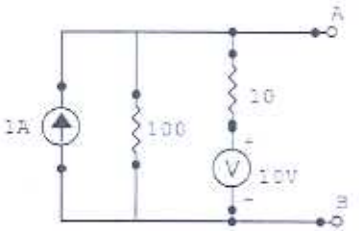
Physics 228 – Quiz#1
November 2007

All resistances are in Ohms and all voltages are RMS.

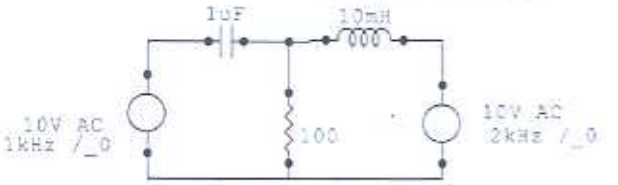
1. Find the equivalent resistance between A and B



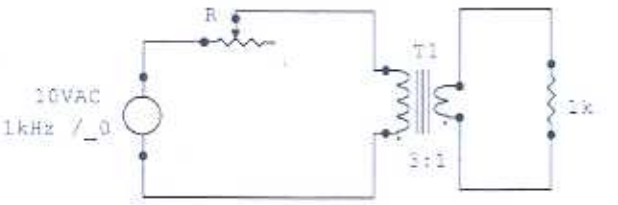
2. Find the Thevenin's equivalent between A and B.



3. Find the current in the resistor and the power delivered to it.

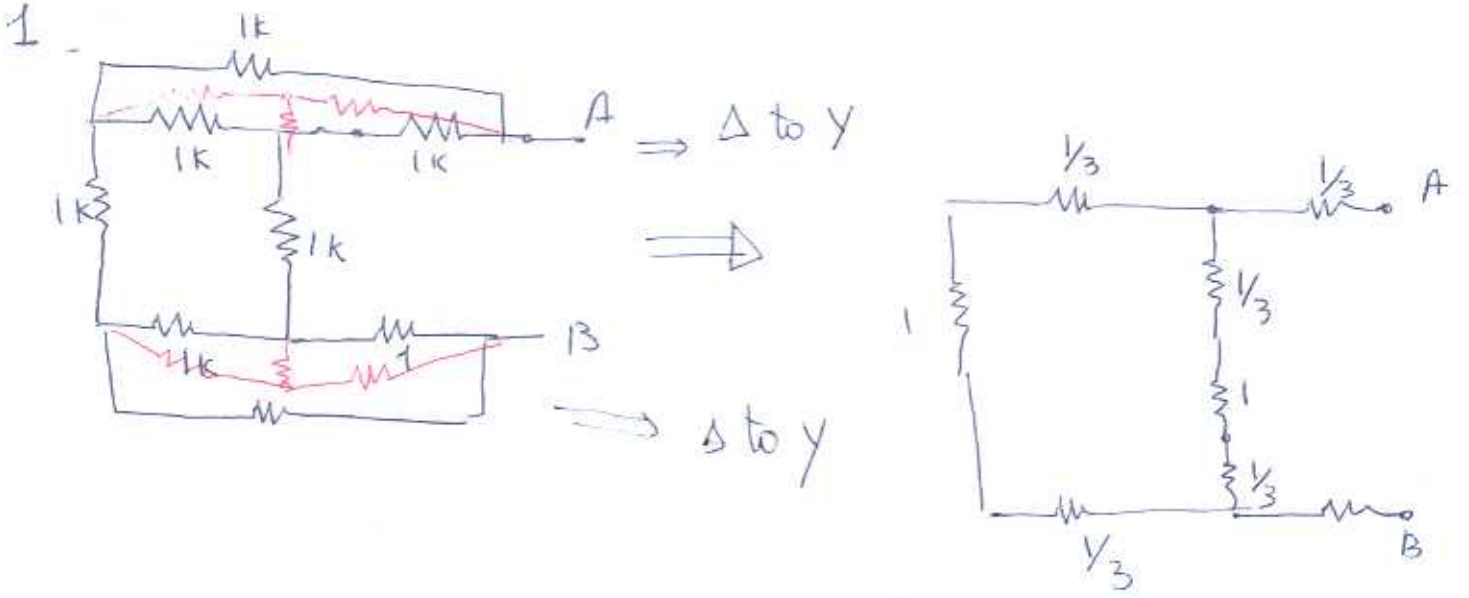


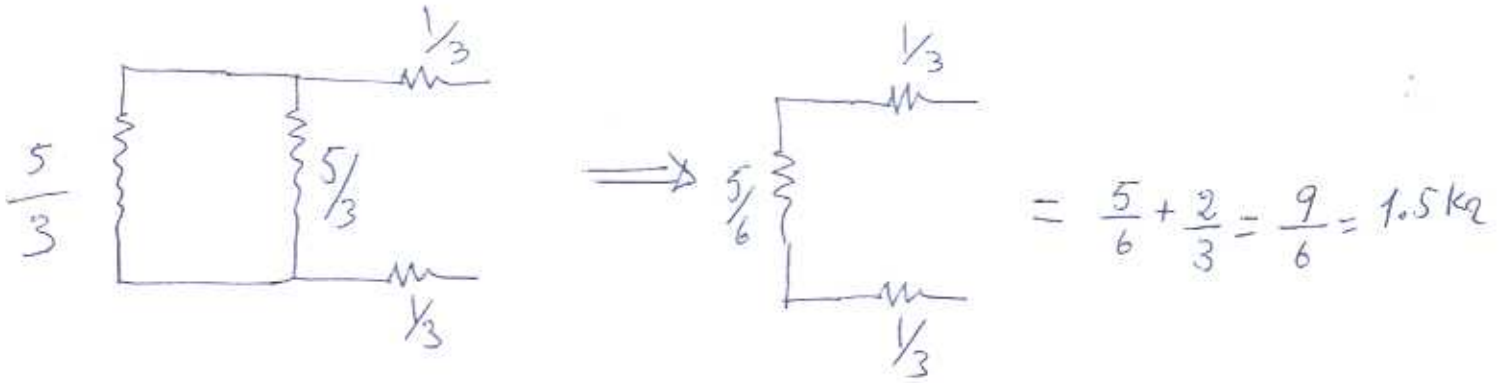
4. The resistor in the primary is variable. Find the value of R so that the power delivered to the 1k Ohm load is maximum. In this case, find the power delivered to the load.



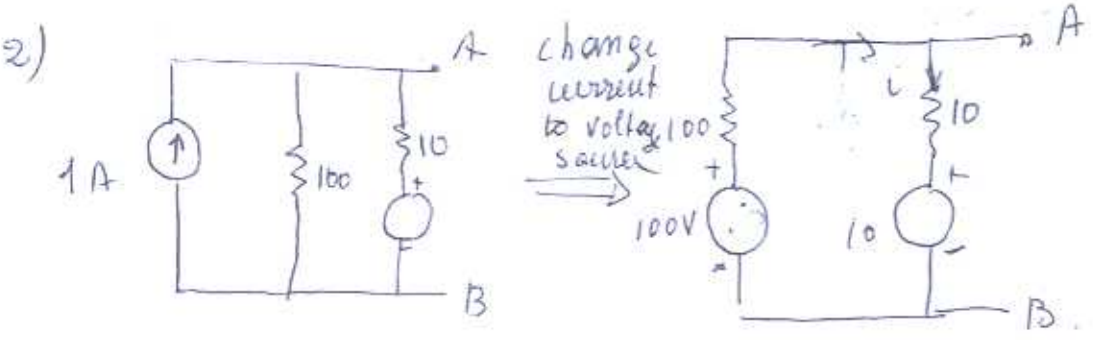
Quiz I

1.





2)



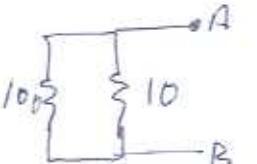
KVL

$100 - 100i - 10i - 10 = 0 \longrightarrow 110i = 90$

$i = \frac{9}{11}\,A.$

$V_{AB} = V_{Th} \Rightarrow V_A - 10i - 10 = V_B \longrightarrow V_A - V_B = \frac{90}{11} + 10 = 18.2\,V.$

$R_{Th} \Rightarrow$ short voltage source



$R_{Th} = \frac{10 \times 100}{10 + 100} = \frac{1009}{110} = 9.2\,\Omega$

3. @ 1 KHz $\omega = 6280$ rad/s

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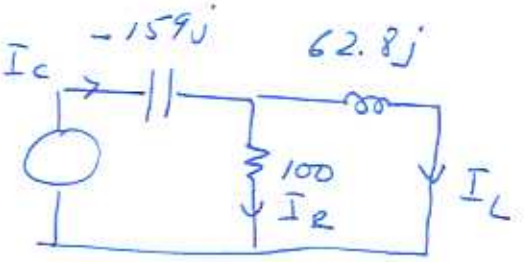
$Z_L = 62.8j$ $Z_C = -159j$

@ 2 KHz $\omega = 125^{-}60$ rad/s

$Z_L = 126j$ $Z_C = -79.5^{-}j$

1 KHz



$$I_C = \frac{10}{45j + 28.3 - 159j}$$

$$= \frac{10}{-114j + 28.3} = \frac{10}{117\angle -76^\circ}$$

$$Z_{11} = \frac{100 \cdot 62.8j}{100 + 62.8j}$$

$$= \frac{62.8j}{1 + 0.628j}$$

$$= 45^{-}j + 28.3$$

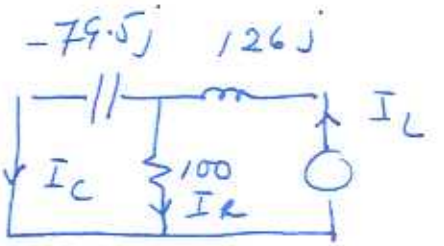
$$= 53\angle 58^\circ$$

$$I_R = I_C \cdot \frac{62.8j}{100 + 62.8j}$$

$$= \frac{628j}{9989 - 9623j}$$

$$= 0.0453\angle 134^\circ \text{ RMS}$$

2 KHz



$$I_L = \frac{10}{126j - 38.7 - 48.7j}$$

$$= \frac{10}{77.3j - 38.7} = \frac{10}{86\angle -63.4^\circ}$$

$$Z_{11} = \frac{100(-79.5j)}{100 - 79.5j}$$

$$= \frac{-79.5^{-}j}{1 - 0.795j}$$

$$= -48.7j - 38.7$$

$$= 62.2\angle 51.5^\circ$$

$$I_R = I_L \cdot \frac{-79.5j}{100 - 79.5j}$$

$$= \frac{-79^{-}5j}{2275 + 10807j}$$

$$= 0.072\angle -168^\circ \text{ RMS}$$

$$i_R = 45.3\sqrt{2}\cos(6280t + 134^\circ) + 7.2\sqrt{2}\cos(12560t - 168^\circ) \text{ mA}$$

$$\text{Power} = (0.0453)^2 100 + (0.072)^2 100$$

$$= 0.72 \text{ W}.$$

4.

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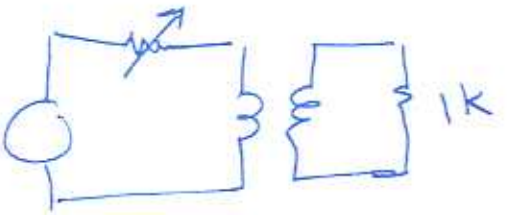

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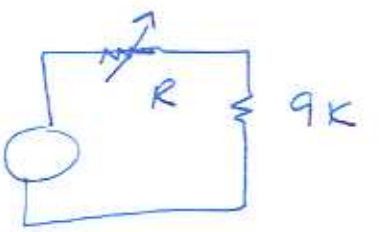

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Maximum power is delivered to the load when $R = 0$ 7

$$P = \frac{10^2}{9 \times 10^3} = \frac{1}{90} \text{ W} = 11.1 \text{ mW}.$$

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